VAM unit
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El Niño Bulletin #5

April 1, 2003

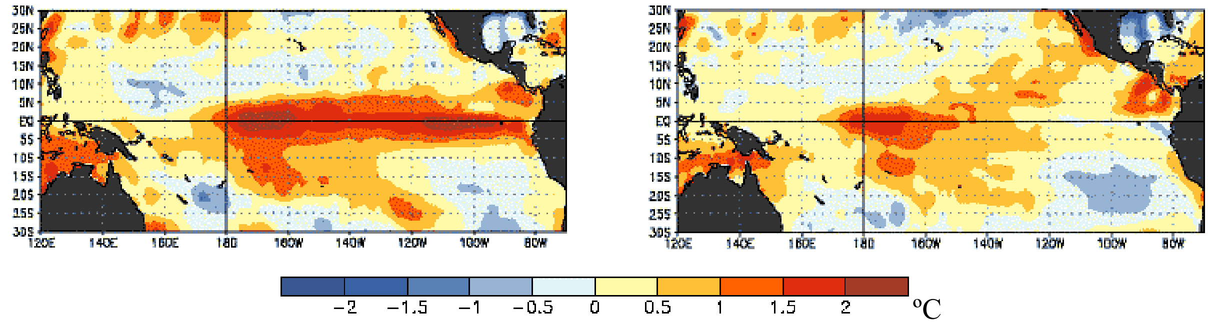
Highlights:

- The El Niño event is decaying.
- Drier-than-normal conditions have persisted across much of the subcontinent throughout the 2002-2003 growing season.
- Conversely, wet conditions have persisted across parts of the subcontinent since January 2003.
- Tropical cyclones Delfina, Fari, and Japhet lifted drought conditions in parts of the region, but concomitantly associated flooding has destroyed some maize areas and damaged others.
- Late-growing-season rainfall accumulations continue to show deficiencies across parts of the subcontinent.
- Erratic rainfall, both in dry or wet regions, is contributing to yield uncertainties.
- Continued rainfall in some parts of the region through the end of March may jeopardize the drying of early harvest maize.
- WFP's prediction for the 2002-03 growing season suggest that over parts of the EMOP region, rainfed maize yields can be expected to be low, due both to drought and flood losses.

This edition of the Bulletin contains an update of the state of the current El Niño event, shows how the region's growing-season rainfall is being affected, provides a snapshot of the tropical-cyclone induced flooding in northern Mozambique, looks at rainfall distribution across the growing season, and offers updated forecasts of yield potentials for maize, sorghum, and pearl millet.

Current El Niño Conditions

Sea surface temperature (SST) anomalies (departures from average) again ***decreased*** across much of the Pacific in February (Figure 1).[1] This indicates a continued weakening of the El Niño event. While both ocean surface and subsurface temperatures in the eastern equatorial Pacific are now typical of the decay phase of an El Niño, the central and western basin remains anomalously warm, and atmospheric indicators in this part of the globe continue to reflect El Niño conditions, as shown in Figure 2.



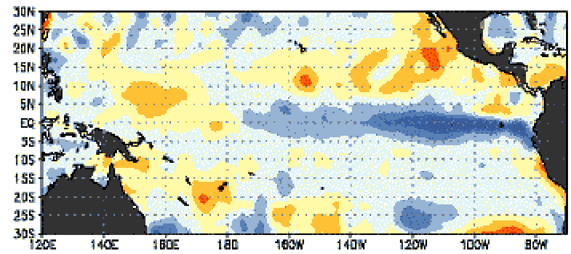


Figure 1. December 2002 (top left) and February 2003 (top right) sea-surface temperature (SST) anomalies (departures from average), computed on 1971-2000 mean values. The zone of warm water seen in December along the equator is typical of El Niño events. The magnitude of cooling SST anomalies (i.e., depicting the weakening of the El Niño) between December 2002 and February 2003 is shown at bottom left.

[1] http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

Consistent with current conditions and recent observed trends, most climate forecast models indicate that El Niño conditions will continue to weaken through March 2003. Thereafter, the consensus forecast is for near-normal conditions from April-October 2003. However, there is a wide spread among the individual forecasts; some predict the possibility of continued weak El Niño conditions, while others indicate the development of La Niña conditions during the last half of 2003. The recent cooling of the upper ocean (surface and subsurface) in the eastern equatorial Pacific supports the possibility of the development of La Niña conditions later this year. The last major La Niña event in 2000 resulted in the worst flooding in decades across parts of the region, notably Mozambique.

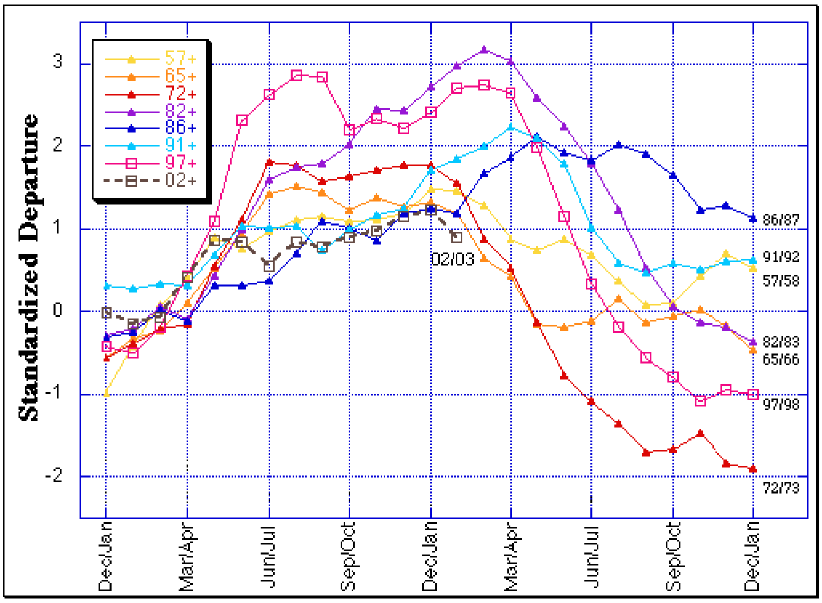


Figure 2. A comparison of the current El Niño event (keyed 02+) with the seven strongest events since 1950. The data points conform to a "multivariate ENSO index," consisting of a weighted average of the following six variables: sea-level pressure, the east-west and north-south components of the surface wind, sea-surface and surface air temperatures, and total amount of cloudiness.

Growing Season Rainfall: August 2002 – February 2003

Figure 3a shows dry conditions to have prevailed during the 2002-03 growing season across much of the sub-continent, the significant exceptions being the cyclone-affected regions of northern and central Mozambique, Malawi, eastern Zimbabwe, and eastern and central Zambia. Across nearly all of southern Africa, the growing season has been drier even than the same period during 2001, a notably "dry" year, as Figure 3b depicts, again with the exceptions above. The 2002-03 comparisons to the 1992-93 and 1986-87 El Niño events are shown in Figures 3c and 3d.

The extent of the current rainfall deficit can best be seen in Figures 3e (absolute difference compared to "normal") and 3f (percent difference compared to "normal"). With the exceptions of South Africa's Cape and Orange Free State Provinces, northwestern Angola, far northeastern Tanzania, patches of central Zimbabwe, and south-central Mozambique, rainfall across much of the subcontinent has been lower than the climatological mean. Some areas of agricultural drought will have been relieved by tropical cyclone Delfina over the New Year, as well as the late-January and early-February near-daily rains over northern Mozambique derived from the remains of Cyclone Fari, then later in early to mid-March by cyclone Japhet, but these rains may have come too late, and in too great a downpour, to be effective. In many cases, they are known from local reports to have caused flooding and loss of standing crops.

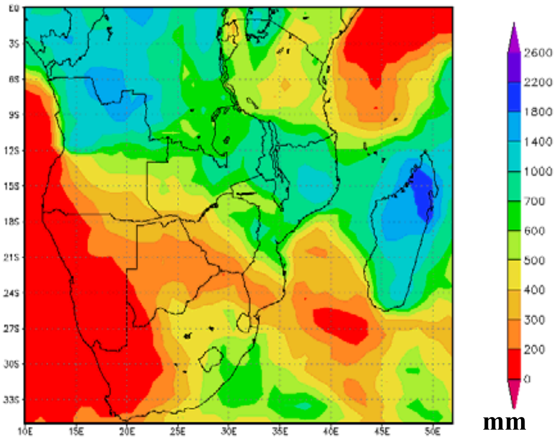
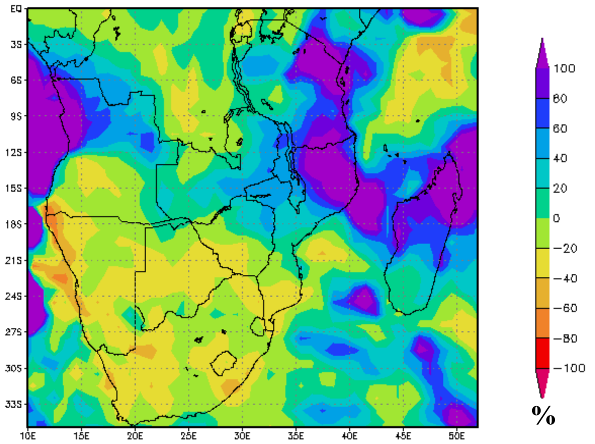


Figure 3a. August 2002 – February 2003 rainfall **accumulations** derived from microwave and infrared satellites, and corrected by ground-level observations. Source: NASA-GES DAAC.



August 2002 – February 2003 rainfall **departures** compared to the same months in 2001-2002, i.e., normalized to show growing-season percent difference. Source: NASA-GES DAAC.

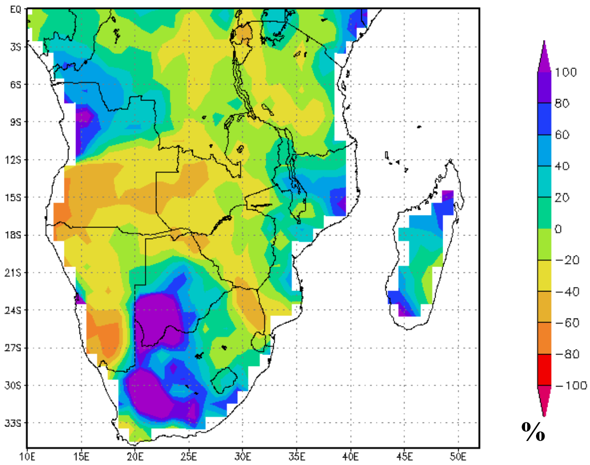


Figure 3c. Comparison of August – February rainfall **departures** with the same months during the 1992 El Niño event, i.e., normalized to show (2002/03–1986/87) percent difference. Source: NASA-GES DAAC.

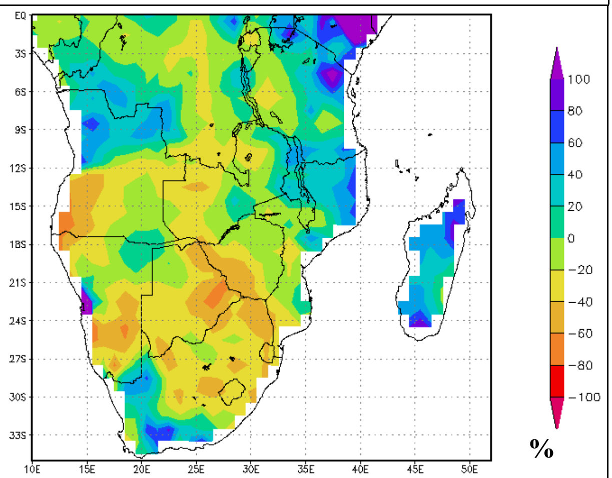


Figure 3d. Comparison of August – February rainfall **departures** with the same months during the 1987 El Niño event, i.e., normalized to show (2002/03–1986/87) percent difference. Source: NASA-GES DAAC.

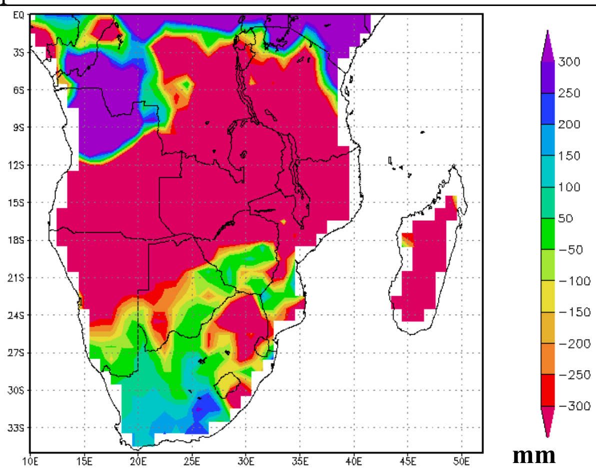


Figure 3e. Comparison of August – February rainfall **accumulations** with "normal" climate, i.e., the same months 1950-1999 that were *not* influenced by either El Niño or La Niña events. Source: NASA-GES DAAC.

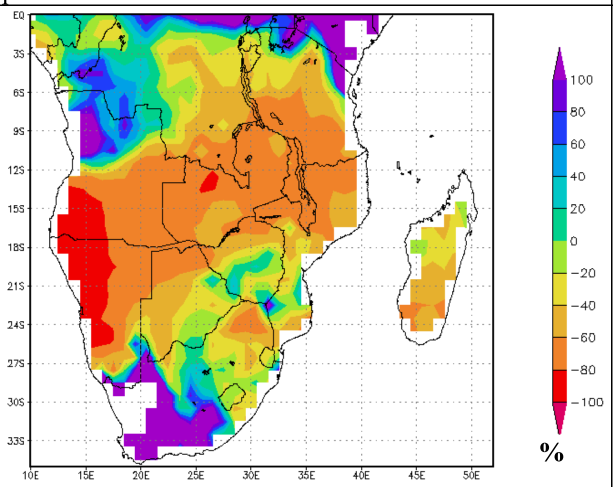


Figure 3f. August – February rainfall **departures**: [(rainfall Aug 2002-Feb 2003) – (mean rainfall Aug-Feb 1950-1999, non-El Niño/La Niña months)]. Source: NASA-GES DAAC.

March 2003 Preliminary Estimates: Continued Wet in Northern Mozambique

Rainfall accumulation estimates for March dekads are shown in Figures 4a-4c. The effects of tropical cyclone Japhet in Mozambique and Zambia are visible in Figure 4a. Rains continued across Zambia and northern Mozambique during dekad 2, as well as Angola (Figure 4b). Conversely, the remainder of the EMOP region as well as Namibia, Botswana, and most of Tanzania received scant rainfall during these 30 days, with southwestern Zimbabwe remaining very dry.

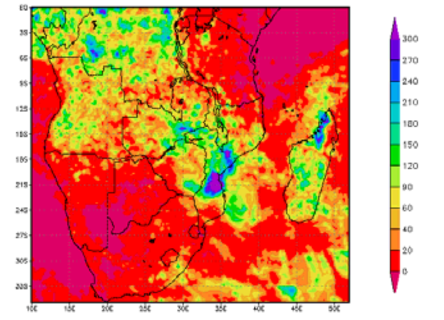


Figure 4a. March 1-10 (dekad 1) rainfall accumulation estimate.

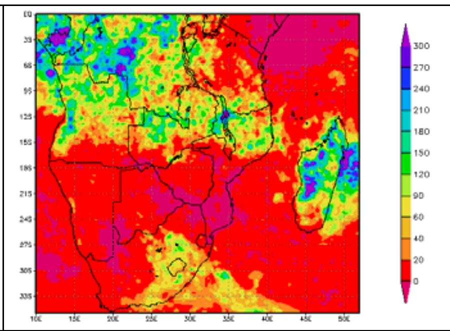


Figure 4b. March 11-20 (dekad 2) rainfall accumulation estimate.

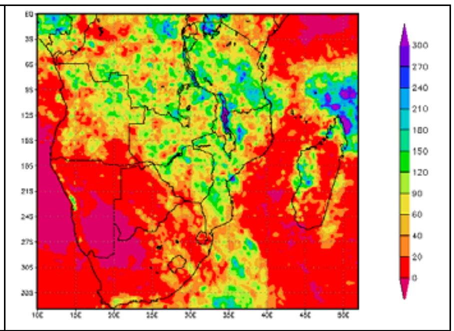


Figure 4c. March 21-30 (dekad 3) rainfall accumulation estimate.

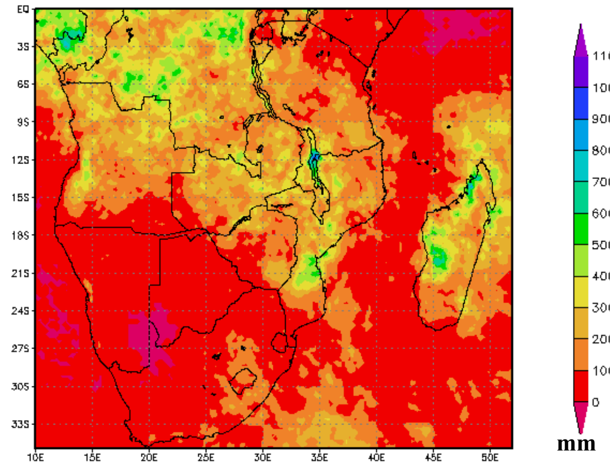


Figure 4d. March 1 – 30 rainfall accumulation estimate.

Source: NASA-GES DAAC. Note that Figure 4 is an unverified estimate. Errors from the algorithms that interpret the satellite data have not yet been "ground truth" corrected, that is, the data from surface meteorological measurements have not yet been included. Note also that the spatial resolution of rainfall in Figure 4 is much more precise than the maps above, since the grid resolution is 0.25º rather than the 1.0º of Figure 3.

Indian Ocean sea-surface temperatures have declined as the southern hemisphere winter approaches, and are not presently conducive to further tropical cyclone formation and development (Figure 5).[2]

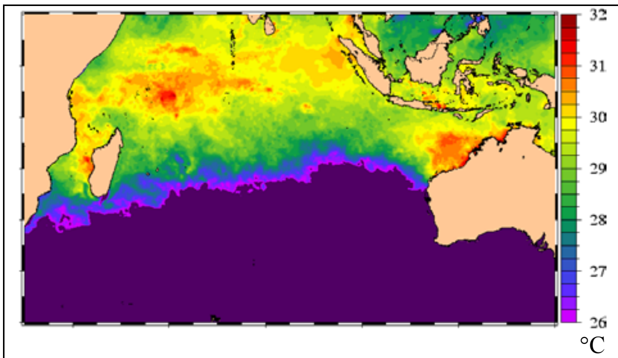


Figure 5a. Indian Ocean sea-surface temperatures ≥26°C, the temperature conducive to typhoon formation and continuance, March 30 2003. Source: Naval Research Lab Stennis Space Center.

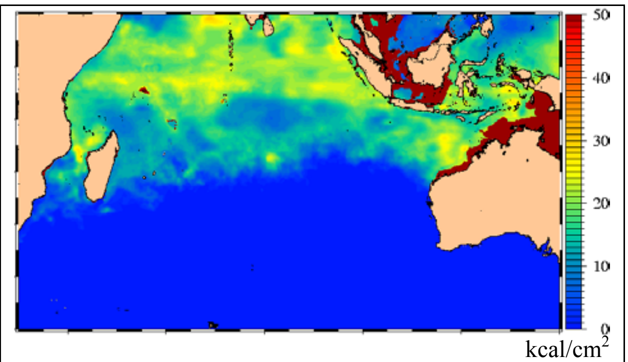


Figure 5b. "Cyclone heat potential" (an integration of the 26°C isotherm from the surface to the ocean floor), March 30 2003. Source: Naval Research Lab Stennis Space Center.

[2] http://www7320.nrlssc.navy.mil/hhc/#sio

__Rainfall Distribution Estimates__

The season, and associated cropping activities, start in the south and move gradually north. In a normal season, planting should begin in South Africa, Swaziland and Lesotho in October, and in northern Mozambique and Malawi in December.[3]

Figure 6 compares each month (August - February) of this El Niño with its climatological "normal" (non-El Niño, non-La Niña) month. If the month's total rainfall is ≤70% of normal accumulation, it is scored = 1, else it has a score of 0. The score is summed. Thus, the map shows rainfall distribution over growing-season months.

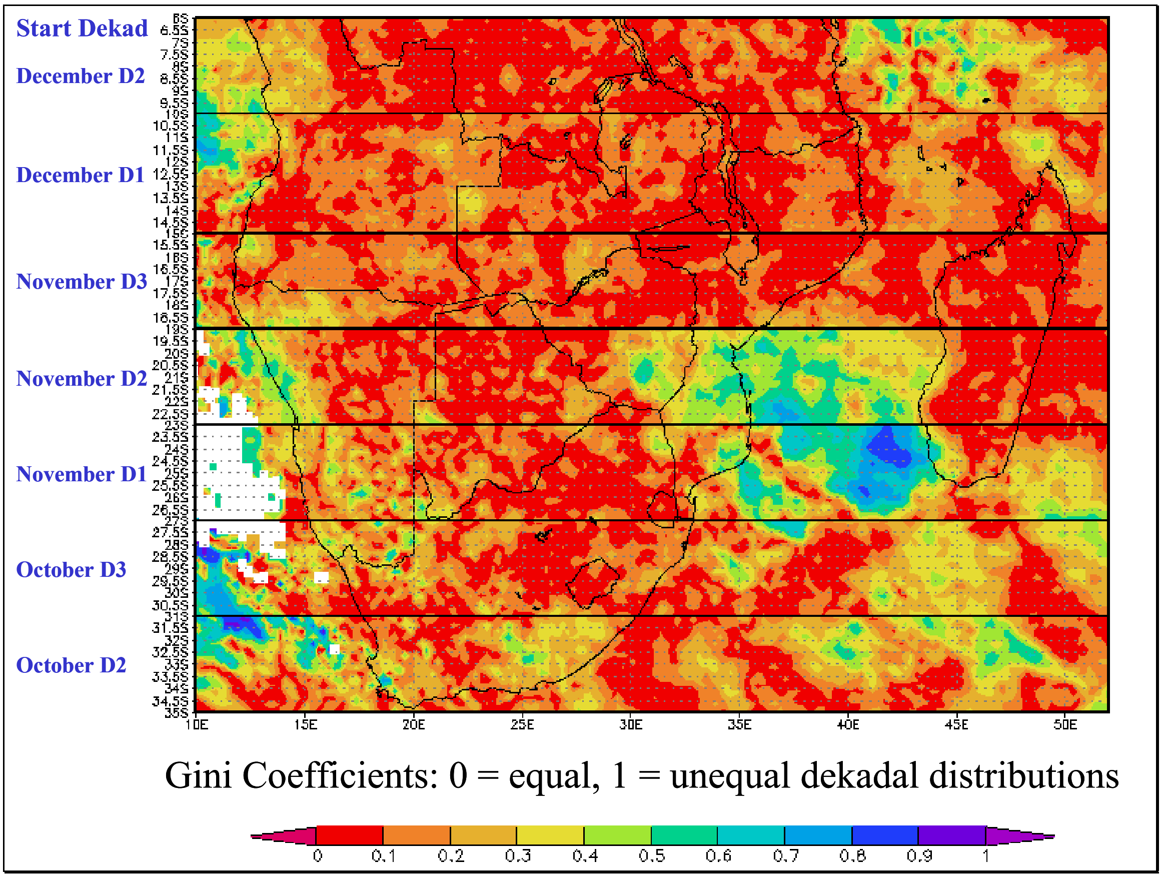


Figure 6. Gini coefficients of dekadal rainfall during a 12-dekad (4 month) maize growing season through March Dekad 3. Note that the northernmost zone has completed only 11 of the 12 dekads of the crop cycles. Source: NASA-GES DAAC.

Figure 6 shows that rainfall was particularly erratic over southeastern Zimbabwe, south-central Mozambique, southern and northernmost Namibia, Eastern Cape province in South Africa, and part of far western Zambia. Erratic rainfall over Zimbabwe and Mozambique can best be explained by the 2003 cyclones, and it is likely that central Mozambique especially has been affected by cycles of drought and flooding.

Figure 7 indicates that much of the subcontinent has had 6 to 7 months of rainfall equivalent to ≤70% of the climatological norm, with the greater part of the remainder of the geographic area having 3-5 months of this norm.

Between these two figures, it is observable that rainfall has both been lower than normal across much of the region as well as that it has been erratic in many places. Conversely, in other areas, such as

[3] http://www.sarpn.org.za/documents/d0000155/index.php

southeastern Zimbabwe, while rainfall has not been greatly lower than normal, it has fallen erratically across growing-season dekads.

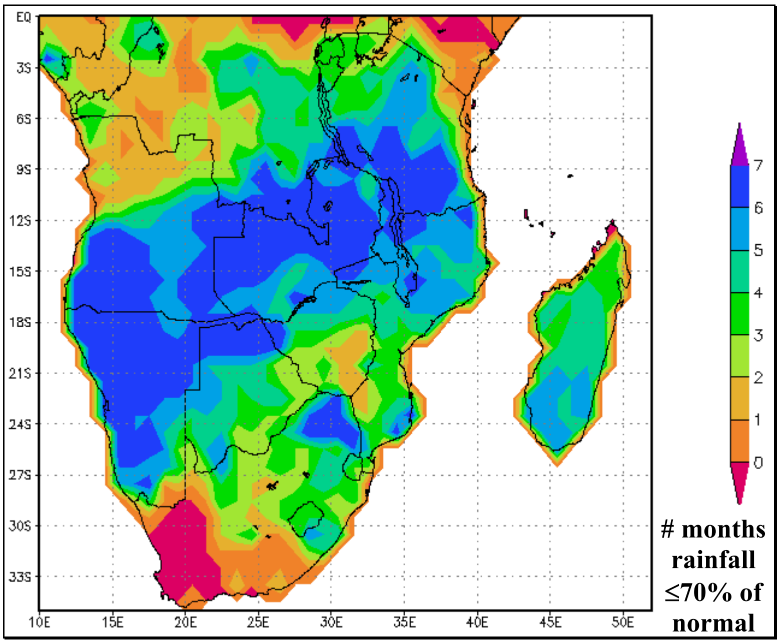


Figure 7. August 2002 – February 2003 monthly accumulated rainfall measured at ≤70% of the equivalent climatological "normal" (non-El Niño, non-La Niña) month. If the month's total rainfall is ≤70% of normal accumulation, it is scored = 1, else it has a score of 0. The resulting monthly scores are summed to produce the map. Source: NASA-GES DAAC.

Correcting the Drought Forecast: Cyclones Delfina, Fari, and Japhet

In *Bulletin #4*, a crop forecast was offered, based on amalgamating measured rainfall in the early part of the growing season with a late-season prediction, one based on average monthly accumulations from January – March for the two recent moderate El Niño events (1986-97, 1991-92). This forecast underestimated the consequences of three typhoons moving inland from the Mozambique Channel between the last days of December 2002 and mid-March 2003. This underestimate is shown in Figure 8a, where the heavy rainfall affecting northern and central Mozambique, southern Malawi, eastern Zambia, and eastern Zimbabwe is clearly visible as blue and purple colors. However, greater-than-expected rain also fell across an arc from southeastern Angola through Botswana as far south as Lesotho, the effects of which are striking when looking at Figure 8b.

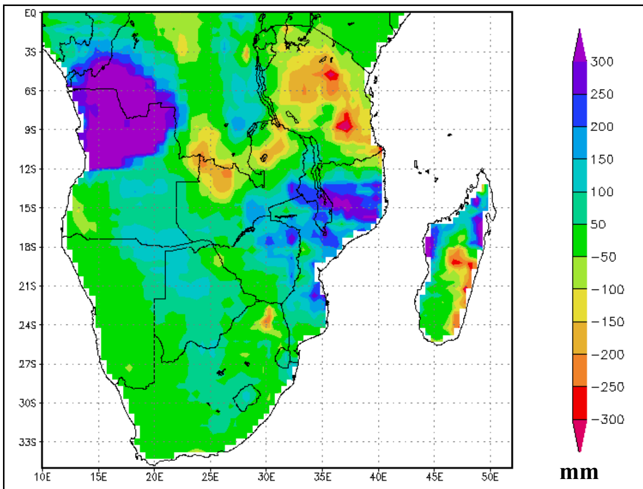


Figure 8a. January – February 2003 rainfall **accumulations** compared to these months averaged for the two recent moderate El Niño events (1986-87, 1991-92). Source: NASA-GES DAAC.

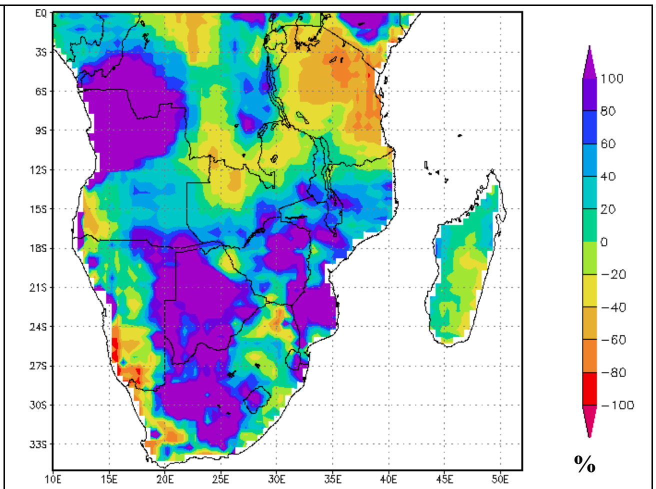


Figure 8b. January – February 2003 rainfall **departures** compared to these months averaged for the two recent moderate El Niño events (1986-87, 1991-92). Source: NASA-GES DAAC.

Crop Forecasts for the April-May 2003 Harvest

In *Bulletin #4*, and based on the similarity in magnitude of the current El Niño event with those of 1986/87 and 1991/92 such that January-March rainfall accumulations were forecast, WFP offered a spatial yield potential prediction for the entire 2002/2003 growing season. Growing-season rainfall accumulation has now been updated, with the only forecast month being that of March (Figure 9a). Originating with measured rainfall accumulations, and after adding the forecast for total growing-season rainfall, it is possible to predict maize yield potential (i.e., departures from the yield expected during perfect growing conditions). Maize yield potential is shown in Figure 9b, which depicts yield declines in southwestern Zambia, southwestern Zimbabwe, southern Mozambique, and most of Swaziland and Lesotho. Very little rainfed maize can be expected in either Botswana or Namibia this year. A band across the southernmost maize zone in Angola can expect reduced yields. Using the identical technique but different yield potential equations, the yield potential for sorghum (Figure 9c) and pearl millet (Figure 9d) is also predicted.

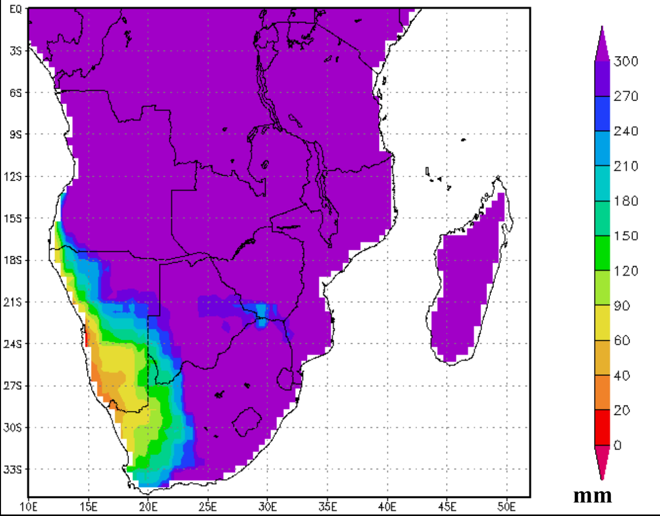


Figure 5a. August–March rainfall accumulations, using Aug-Feb measured accumulations and adding March estimates based on the spatial average of this month during the 1987 and 1992 El Niño events. Source: NASA-GES DAAC.

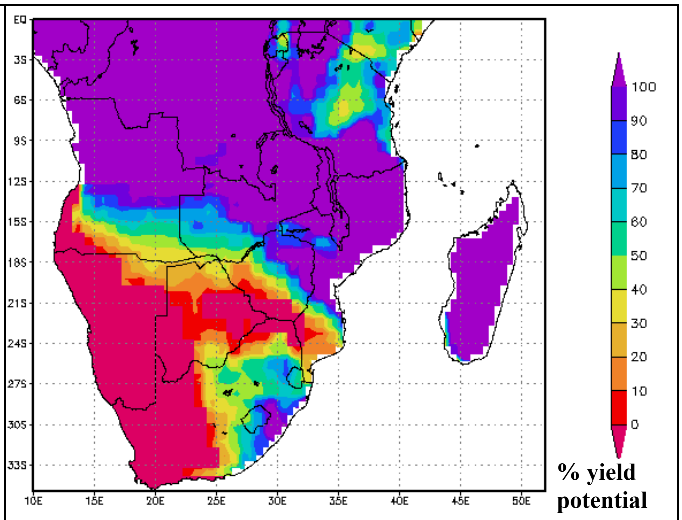
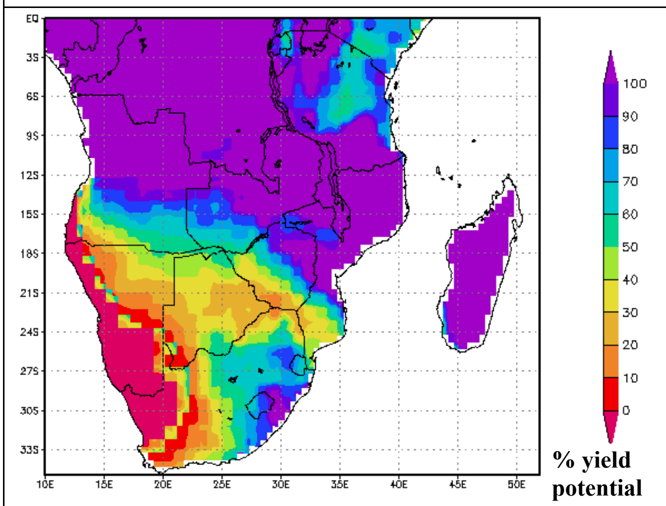


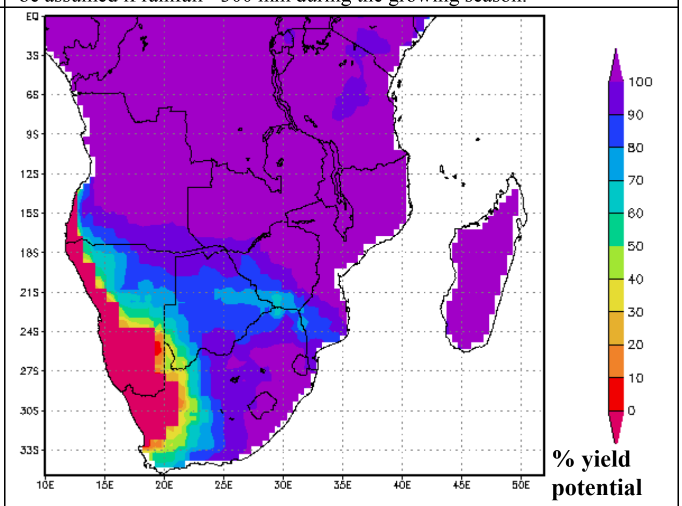
Figure 5b. Maize yield projection based on estimated rainfall (Figure 5a), and using the CIMMYT-derived empirical equation below. Source: NASA-GES DAAC.

[Yield Potential (%) = [rainfall (mm) × 0.25] – 75], where zero yield can be assumed if rainfall <300 mm during the growing season.



Sorghum yield projection based on estimated rainfall (Figure 5a), and using the ICRISAT-derived empirical equation below.

[Yield Potential (%) = [rainfall (mm) × 0.182] – 27.27], where zero yield can be assumed if rainfall <150 mm during the growing season.



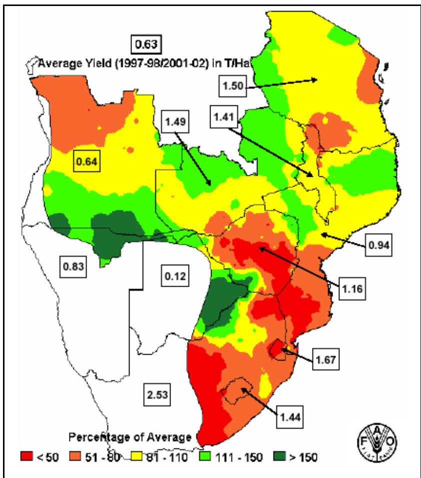
Pearl millet yield projection based on estimated rainfall (Figure 5a), and using the ICRISAT-derived empirical equation below.

[Yield Potential (%) = 127 – [13,734 ÷ rainfall (mm)]], where zero yield can be assumed if rainfall <110 mm during the growing season.

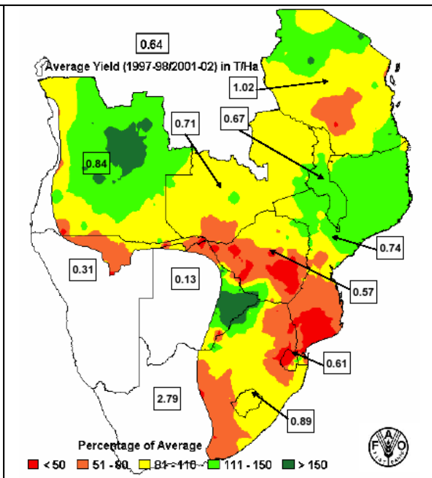
The above predictions are based on a single parameter, rainfall and its empirical relationship to yield, and should be considered as experimental. More-sophisticated crop forecast/crop water use models, such as those produced by FAO, incorporate evapotranspiration and soil type parameters. FAO's Agrometeorology group has recently predicted yield potential based on recent yield averages for these three crops (Figure 10). The significant differences between the WFP and FAO predictions are:

- *Maize*: FAO shows greater success in southwestern Zimbabwe, eastern Botswana, and northwestern Limpopo province in South Africa, while predicting lower harvests in south-central Mozambique.
- *Sorghum*: differences are again observed in the southwestern Zimbabwe, eastern Botswana, and northwestern Limpopo triangle, with FAO showing greater potential there, as well as in south-central Mozambique and southern Angola.
- *Pearl millet*: there is broad agreement except in southwestern Angola and northernmost Namibia, where FAO predicts greater yield success.

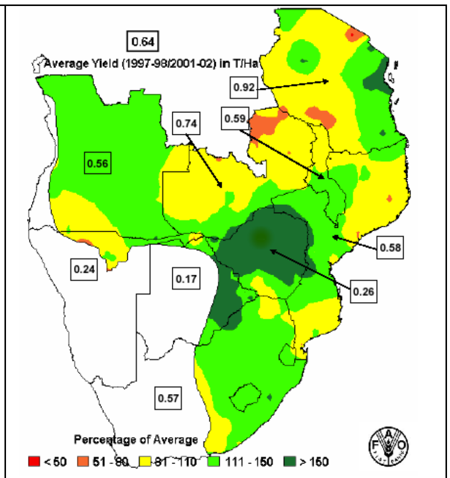
Given that the NASA-measured rainfall has been deficient in the southwestern Zimbabwe, eastern Botswana, and northwestern Limpopo triangle, it is difficult to understand FAO's optimistic prediction for this area. Figures 3a, 4d, and 6 indicate that not only has rainfall been low there, but also that it has been relatively erratically distributed across the 12 growing-season dekads. The rain that has fallen could have done so torrentially, resulting in significant runoff rather than infiltration.



FAO's maize yield estimate.



FAO's sorghum yield estimate.



FAO's pearl millet yield estimate.

Source: FAO-SDRN Agrometeorology group, March 10 2003 product.

In view of the continued drought and erratic rainfall in some parts of the subcontinent, and the effects of the three cyclones coupled with erratic rainfall over others, WFP expects the need for emergency food assistance to continue during 2003. However, emergency requirements do not at this time appear to be anywhere as great as those of last year.

Questions may be directed to the author of this report via email, Lenard.Milich@WFP.org. The next Bulletin will be completed in approximately one month.